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Potassium in Nutrition; Consumer's Credo

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Potassium in Nutrition

Why do some scientists believe potassium to be the most important major organic mineral in nutrition?

The laws of life, growth, and health in plants, animals, and man are clearly interwoven with the mineral elements in their food supply. Of these mineral salts or electrolytes, potassium, which ranks third in quantity (behind calcium and phosphorus) is most essential in organic synthesis. It also qualifies as one of the most needed minerals to maintain good health in both plant and mammalian life. If only a small amount is available, the plant will depend on this amount (as a growth-limiting factor) and grow in proportion to the potassium available, irrespective of the quantity in which other mineral nutrients may be supplied.

In mammals a small amount in the blood maintains alkaline mineral balance and is essential for proper function of the various organs of the body. Potassium is also the chief cation (elector-positive element) of intracellular fluid. however, a small amount is present in the extracellular fluid as well. Billions of body cells consistently pour minute portions of potassium into the extracellular fluids, which are then reabsorbed or excreted in the urine.

From *Sea Within: The Story of Our Body Fluid*, by William D. Snively Jr., MD, we learn that this process, as well as related activities with other electrolytes, is influenced by the adrenals, kidneys, parathyroid, and pituitary. Although all of these organs are vitally important, Dr. Snively considers the kidneys, because of their variable functions, to be the "master chemists of the body." By controlling the excretion of both potassium and sodium, the kidneys maintain a suitable balance of the body fluids, under normal conditions.

Important for Osmotic Balance

Granting that potassium and sodium have similar and reciprocal properties and an approximate daily maintenance requirement of five grams of each, the location within the body is entirely different. Sodium is mostly in the extracellular fluids that circulate outside of the cells, with very little within the cell itself. Potassium is primarily an intracellular element. It is this interrelation between these two minerals in their respective locations that permits many substances to pass back and forth between the cells and their surrounding fluids. This exchange process is known as osmosis. Living cells formed of semipermeable membranes depend on osmosis for much of their activity. Therefore, the distribution and reciprocal action of sodium and potassium are very necessary in the normal intracellular ionic environment. Osmosis is a vital physiological function and is particularly indispensable in keeping a normal balance of water between the cells and the extracellular fluids.

This is an important function when we consider that the water content of a person weighing 150 pounds is estimated to be 90 pounds. Although the body fluids do account for roughly two-thirds of the weight of the body, more important is the fact that it also carries the physical and chemical characteristics required in the cycle of life. The amount of these electrolytes so vital in keeping the normal balance of water are in the proportion of 9:4 (nine ounces of potassium to four ounces of sodium). This critical balance is often upset by persons who habitually take sodium bicarbonate or other sodium alkalizers for heartburn, gas, or acidity possibly associated with gastric ulcers, as the action of the potassium-rich intestinal digestive juices is nullified.

The increase of sodium causes a transfer of water and potassium from the cells into the extracellular fluids. The excess sodium then usurps the place of the lost potassium in the cellular fluid causing an acid-alkaline mineral imbalance and a toxic condition leading to cell destruction. This habit, if pursued for any length of time, has been known to cause hypernatremia and terminate in a waterlogged system. Unbalancing the body fluids usually leads to poor health, as animal experiments have determined that contents must be maintained at precise levels if we are to remain normal. In health, however, potassium excretion in stools and urine is balanced with ordinary intake.

Systemic Unbalance

When potassium moves out of the cells to partially compensate for electrolytes lost from the extracellular fluid, it is presumed to be lost from the body by excretion. If this loss is severe it may interfere with the acid-alkaline ash mineral balance and produce a preponderance of acid ash minerals. Correction of an acid-base disturbance often requires a replacement of the deficit of potassium. As food is our source of this electrolyte, adding potassium-rich foods to the diet reverses the procedure and restores potassium. Then, too, it is a safe method, as again we are confronted with a critical balance, for, as potassium moves into the cells, the plasma levels may fall causing a metabolic mineral imbalance. Restoration of potassium levels corrects this tendency.

Hypopotassemia

Potassium may be lost from the body in various ways and through a variety of conditions. Probably one of the most insidious ways is through the inordinate use of laxatives, as most of these substances cause a watery stool with excessive loss of electrolytes. Clinical signs and symptoms of potassium deficiency have been reported, in some cases, as due to habitual abuse of laxatives. Also, the constipation may be aggravated by this loss, causing a further decrease of intestinal muscular peristalsis. Diarrhea and vomiting invariably cause a loss of considerable potassium.

In *Stress* (1950), page 197, Dr. Hans Selye observes derangement in potassium metabolism due to systemic stress, such as "after hemorrhage, burns, X-irradiation, exposure to cold, nervous and emotional stress, forced muscular exercise, anoxia, acute infections, e.g., toxic diphtheria, malaria or experimental pneumococcus-infections, intoxication with vesicants, starvation, intestinal obstruction and gravity shock."

One might conclude, however, that the most probable common cause of lack of potassium would appear as a result of a diet providing insufficient ingestion, due to a dietary intake of refined flour and sugar products, poor absorption from the small intestine, apparently due to anatomical, mucosal or enzymatic defects, or excess elimination through the kidneys. In regard to the latter, the kidneys appear to have a strange disregard for the conservation of potassium as so much of it is lost to the body in the excretion of urine, even though the deficit may be severe. This is an amazing circumstance, as in all other instances the kidneys retain and tend to balance or maintain a constant volume of the electrolytes needed for the extracellular fluids. It could be due to an exclusive action the other electrolytes may not possess, for potassium acts as a diuretic in that it stimulates the kidneys to excrete water in the important action of carrying away poisonous waste matter. In fact, potassium depletion, if severe, might possibly lead to renal failure due to degenerative changes within the kidney tubules, in addition to disturbing the function of various other dependent organs.

Animal experiments have determined that any impairment of the kidney causes it to lose potassium faster. In regard to kidney damage, Dr. Robert E. McCombs in *Fundamentals of Internal Medicine*, Third Edition, 1965, page 215, states:

> "Chronic hypokalemia may cause secondary changes in renal tubules, diminished function, and uremia. If recognized and promptly and adequately treated, this is a reversible lesion, and full restoration of renal function is possible. Confirmation of the diagnosis is readily obtained by determination of the serum potassium level."

This constant problem of balance in the healthy individual could be magnified many times in the event of stress or illness when either the quantity or chemical composition of the electrolytes varies from the normal and presents an invitation for disease to take over.

Antagonists and Partners

The extracellular fluid in addition to water and potassium contains the following known electrolytes: sodium, calcium, magnesium, chloride, acid, alkali and other unknown but presumably active physiological salt substances. Dr. I.S. Kleiner, Professor of Biochemistry of New York Medical College, stresses the importance of mineral balance in mammalian intake when he says, "When there is an excess of sodium, potassium or chloride in the diet,

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Guest Blog Post Submission Form calcium, magnesium and phosphorus must be provided to balance off the excess amount."

Often potassium and phosphate losses are parallel. In fact, potassium combines with phosphate, inositol, and creatine to form phosphagen or dipotassium-creatine-hexose-phosphate. Phosphagen is present in all muscular tissue and may also be found in some other tissues. According to Blakiston, "It (phosphagen) breaks down during the anaerobic phase of muscular contraction to yield creatine and phosphate and makes energy available for the contractile process."

In muscular dystrophy or dystrophia (defined as imperfect or faulty nutrition), investigators find that excess urinary loss of creatine causes the phosphagen to disintegrate. The importance of potassium in tissues and its probable real function in muscular action is now apparent. Matthews found that the male test animal needs twice as much potassium as the female. The stored power of the phosphagen furnishes the energy to act as a propellant for the torpedo-like action of the sperm. Also, hypopotassemia has been found to cause painful menstruation in the female.

Apparently, one of the first scientists to ascertain nutritional effects by scientific observation, Matthews, had this to say, "Potassium is necessary for the life of every living thing so far tested." More recently, electrolyte impaired activity has been found to be one of the results of a prolonged deficiency. Dr. R.T.S. McDowall, a former professor at the University of London, states in his text, *Handbook of Physiology*, 1964, page 276:

> "In regard to diet generally and to salts in particular, it is pointed out that a given article of diet, particularly of a vegetable nature, is not always of the same composition. This depends, to a very considerable extent, on the soil in which the vegetable is grown…But the presence of the salts in the diet does not necessarily mean that they are absorbed in to the bloodstream. This may be interfered with by the presence of other substances in the diet; for example, excessive calcium reduces the absorption of iodine. Sometimes, too, conditions are present in the intestine which upset absorption. This is common in relation to both iron and iodine. There seems to be little doubt that some benefits attributed to 'change of air' (climate) are attributable to change in the mineral intake."

In plant life potassium has been found necessary for basic physiological function, such as the synthesis of proteins, normal cell division and growth, the formation of sugars and starch and their movement within the plant, and also the neutralization of organic acids. A low supply of potassium in the soil could cause a low cation-exchange capacity in the plant and indicate that potassium supplementation to the soil is necessary. Losses of soil potassium usually occur through overcropping, leaching, and erosion. The organic method of replacement is to plow under a green growing crop. Researchers now find that the nitrogen, phosphorus, potassium commercial fertilizer formula has caused a soil mineral unbalance affecting the health and life of plants, animals, and man. According to Dr. Richard D.S. Miller, a Yale University ecologist, man is on the brink of self-destruction due to the "egotistic idea that man is not an animal and so not subject to nature."

Apparently, it is necessary that these elements became modified through various chemical combinations with other substances (protein, etc.) before they can become plant foods. The plant in turn transforms them into a higher form of organic combinations. For instance, a combination of potassium and phosphorus make up the greater part of the mineral contents of the seeds of plants and the muscular tissues of animals.

Results of Potassium Deficiency

Potassium depletion has been associated with both functional and structural derangements. Future cell research may elicit and document many more abnormalities due to this deficiency. Science now recognizes that sodium chloride (common table salt) with its 43 percent sodium content does unbalance potassium requirements and may interfere with water balance, digestion (of protein in particular), and that it also has in some instances caused glandular swelling, skin diseases (such as acne and eczema), scurvy, albuminuria, hypertension, tachycardia, and nephritis. In ionic equilibrium these minerals, in addition to other functions, tend to provide and regulate nervous and muscular energy. Potassium exerts an influence on the excitability of nervous tissue and the contractability of all types of muscle, heart muscle included. The most active and important muscle in the body, the heart, is no doubt the first to feel a potassium deficiency. It can lead to an enlargement, due to cellular edema, muscle degeneration, connective tissue degeneration, and eventually necrosis.

Since all muscles contain relatively high amounts of potassium, Drs. D. Simmons and Sidney Franklin, a team of researchers at the UCLA Medical College, advise that heart conditions usually can be predicted with a change occurring in normal potassium levels. Apparently, this is due to the fact that the heart needs potassium as a relaxant between contractions. This effect on heart muscle has often caused confusion by altering an electrocardiogram through an imbalance of potassium. Such discrepancy may also affect the integrity of the entire nervous system.

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In the May 1969 issue of *Geriatrics*, the editorial by Dr. Chauncey Leake states, "Potassium ions are needed to balance sodium ions in relation to nerve conduction and muscular activity and probably are needed for many healthy glandular functions also."

Changes in concentration or loss of electrolytes, particularly so with potassium and sodium, necessitates a new osmotic balance. In animals a potassium deficient diet, or feeding salt in excess, produces high blood pressure due to a higher retention of water and blood in the soft tissues. In humans also, excess ingestion of salt causes high blood pressure, and according to autopsy examination such individuals often die from an apoplectic stroke.

In 1953, Dr. R.A. Womersley et. al. reported that persons eating table salt as desired excreted nine times more potassium than when their salt intake was limited. Also, volunteers kept on a potassium deficient diet retained an excess of salt.

In an insufficient amount, the potassium ion acts as a universal depressant affecting especially the circulation and central nervous system, and in some instances results in paralysis. In the June 1966 issue of *Nutrition in Clinical Medicine*, Professor of Medicine at the University of Iowa, W.A. Krehl, MD, PhD, and a renowned researcher states:

> "The mortality rate from all causes is much higher in potassium depleted patients than in the undepleted. As a matter of fact, several studies have indicated that a potassium deficiency exists in perhaps as many as 20 percent of all hospitalized patients."

It is an established fact that without potassium our adrenals cannot function. Without potassium we cannot store sugar in the liver. Without potassium our autonomic nervous system gets out of order: we have a reduced and subnormal activity of the vagus system, also a consequent unbalance of our autonomic controls that can bring on mysterious troubles difficult to recognize as being a result of inadequate nutrition. We list a few of these conditions, namely: eye weakness, loss of accommodation, nervous instability, rise in blood pressure, rapid heart, slow healing rate, low sugar tolerance, neurasthenia, atonic constipation, and also reduced activity of the liver and pancreas. Dr. Krehl says the list is lengthening through further research.

Potassium in the Diet

Due to the unusual antagonistic and reciprocal nature of both sodium and potassium, the extremely low sodium diet should only be assigned by practitioners after a thorough individual study of heart and kidney damage and a probable potassium deficiency created by the prolonged use of diuretics, cortisone therapy, loss of potassium in cooking water, and a lack of suitable nutriments in the diet.

Nutritionally inclined doctors are now recommending a higher potassium instead of a low salt diet to overcome some of the perverse effects of the low salt diet and also to balance the many new sources of sodium salts designated on the labels of our commercial foods, as well as to act as an enzyme activator. Some of the high potassium foods being suggested are bran and buckwheat cereals, most fish, raw honey, milk, most whole meats (sausage and cold meats being ruled out since they contain sodium nitrate and sodium nitrite as preservatives), most vegetables (especially the green leaf variety), raw sugar cane juice, edible seeds, and wheat germ. Apples and most fruits, butter, cheese, and eggs also furnish some potassium.

Doctor Krehl further comments, "If food habits had always been sound, the event of potassium deficiency and depletion would not have developed as a major medical problem…Early clinical suspicion of undue potassium loss and prompt correction may prevent more serious difficulties."

Some of the first symptoms of potassium deficiency to occur are malaise and a sense of not feeling well. Muscular weakness invariably follows and in instances of chronic potassium deficiency, these symptoms are frequently interpreted as being due to "nerves." This diagnosis of emotional instability apparently occurs because of the vague muscle and abdominal aches and pains associated with low potassium. Also, infrequently patients may complain of difficulty in swallowing and a choking sensation due to acute muscular paralysis. Severe muscular weakness and paralysis often begins in the muscles of the extremities and later may involve the muscles of respiration. Physical examination usually does not elicit any demonstrable or characteristic signs except distant muffled heart sounds and probable hypoactive tendon reflexes.

In the summary of a recent article by Dr. A. Reinberg of Paris, France, we find that in 24 hours a healthy adult man loses from 2.8 to 4.3 grams of potassium. Excretion by the kidneys accounts for 90 percent of the loss. The compensation is made through nutrition. An extracellular concentration of potassium amounting to about .5 to 1.5 grams is necessary for the breakdown of carbohydrates and proteins, for the work-maintenance of the nerves and muscles, and to produce activity of the glands. Dr. Reinberg advises:

> "Health depends, among other things, on a sufficient potassium supply by nutritional intake. In most cases the

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Apparently, scientists have now proven the importance of potassium in nutrition.

A Consumer's Credo

We, the peoples of the earth, bear the ultimate responsibility for what happens to our world.

We hold life to be infinitely precious. It must be cherished, nurtured, respected.

If these beliefs are to have reality, we must accept duties to each other and to the generations of men to come.

We have the duty to ennoble life on earth and to protect it against assault, indignity, injustice, discrimination, hunger, disease, and abuse.

We have the duty to safeguard the conditions of existence, to develop and use the world's resources for the human good, to protect and preserve the soil so that it will yield ample food, to keep air and water free of poisons.

We have the duty to use our intelligence and knowledge in the making of bountiful life on earth for all men, and to encourage the full development of individual man.

In order to carry out these duties, we must assert the primary allegiance of man in the family of man.

—*Saturday Review*, January 28, 1967

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